

Forest Pest Management

Pacific Southwest Region



Lat 40,59309 Lon -120, 91104
Lat 40,31711 Lon -120, 85209

February 28, 2000
File Code: 3400

To: District Ranger, Eagle Lake Ranger District, Lassen National Forest

Subject: True Fir Monitoring Studies Progress Report (NE00 – 08)

Background Information

These studies were initiated to provide additional documentation concerning salvage marking guidelines for true fir. The interim guidelines for California Spotted Owls were implemented in the early 1990's (ref. 2670/2430 memo, July 24, 1991). This memo reflected an agreement between the Forest Service and the U.S. Fish and Wildlife Service which stated, "...only dead trees and those expected to die with 6 months..." would be included as salvage. Furthermore, the understanding was that "dead within 6 months" meant that the foliage would be 100% faded within the 6 month time period. Salvage marking guidelines were to be reviewed and agreed to by the Forest Silviculturist, with input from Forest Pest Management (FPM) specialists.

The principal purpose of this direction was to specifically identify dead trees in order to expedite their salvage. Any sale that met this criteria could then be exempted from the owl calling protocols and later, could also be exempt from the cumulative effects analysis process. A memo from the Regional Forester to Forest Supervisors (ref. 3400/2430 memo, August 17, 1992) expressed concern over the tremendous variation of understanding of the requirements regarding California spotted owls and salvage marking. The memo stated that "...some forests have construed the direction to mean that only trees 100% dead could be marked..."; other forests interpreted the direction to include any trees that might die within 2-5 years could be sold without owl calling or completing the cumulative effects process.

It was at this point the Director of State and Private in the Regional Office (ref. 3400 memo, June 19, 1992) requested the Forest Pest Management Entomologists to convene to discuss the salvage marking guidelines for Forests managing for California Spotted Owls. The outcomes of this meeting were as follows:

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- Six month salvage marking guidelines were developed for true fir, ponderosa, sugar and Jeffrey pine that were applicable Region-wide (Attachment 1).
- Protocols were developed to assist the Forests in establishing studies to determine the longevity of white and red fir which could be used to support the Region-wide guidelines, to modify them or provide documentation for exceptions to them.

The following true fir monitoring studies were initiated on the Eagle Lake Ranger District, Lassen National Forest, by Forest Pest Management staff at the request of District personnel.

Results

These results are summarize for information collected to date for two True Fir Administrative Studies implemented in August and September, 1995. The purpose of these studies was to evaluate, document and monitor the longevity of fir trees that exhibited signs and symptoms of insect and/or disease activity. A copy of the study plan is attached to this report (Attachment 2). Table 1. shows the dates the trees have been monitored to detect changes in conditions.

The trees were originally selected during September, 1995. One hundred trees were selected at each of two sites: Antelope Mountain and Hamilton Mountain. At Antelope Mountain 56 white fir and 44 red fir trees were included and at Hamilton Mountain there were 61 white fir and 39 red fir trees. The heights, DBH's and condition of the trees when chosen for monitoring are summarized below (sites are combined):

Red Fir:	Height ranged from 38 to 126 ft. DBH ranged from 11.8 to 40.6 in. Total crown as a percentage of tree height (45 to 97.8%). Dead crown as a percentage of total crown (0 to 62.8%).
White Fir:	Height ranged from 37 to 138 ft. DBH ranged from 10.3 to 48.2 in. Total crown as a percentage of tree height from 48.8 to 94.5 %. Dead crown as a percentage of total crown from 0 to 77.2 %.

External characteristics on some trees included scattered branch flagging, white frass, red frass, and emergence holes, logging scars and Cytospora canker.

Table 1. Dates trees were monitored.

Activity	Antelope	Hamilton
Study Initiation	September 12, 1995	September 26, 1995
Monitored	July 16-21, 1996	June 10, October 23 & November 12, 1996
Monitored	October 17-22, 1997	July 29 & August 4, 1997
Monitored	September 3, 1998	Ocotober 8, 1998
Monitored	July 8, 1999	July 22 & 26, 1999

Antelope Mountain

The study trees at Antelope Mountain are located east of the Lookout along F.S. Roads 32N73, 32N03, 32N48 and 32N58A. Elevation ranges between 7,200 and 7,400 feet and the trees are located in the 40 in. isohyetal precipitation zone.

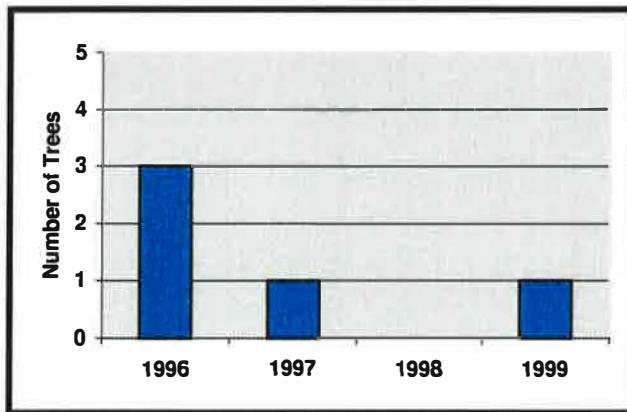
As of July 8, 1999 five trees have died (whole crown fade for the purposes of this study). The initial condition of the trees is summarized in Table 2. Figure 1. displays the number of trees by the year they died.

Current conditions of the remaining live trees are as follows: 14 trees have dropped their faded needles from 1998 but showed no other changes, 6 trees have thinning tops, 1 tree has splitting bark, and 72 trees were unchanged. Three trees are missing and we presume were harvested.

Table 2. Summary of Antelope Mtn. trees that have died since the study was initiated.

Tree #	Species (in)	DBH (in)	% Top Kill	Scattered Branch Flagging	% Circumference with frass	Date Dead
30	WF	10.7	0	10	10	July 96
52	WF	21.5	35	none	10	Oct. 96
60	WF	17.1	25	none	10	July 96
66	RF	30.5	0	none	0	July 99
70	WF	15.8	30	none	0	Sept. 97

Figure 1. Number of trees by year of death.



Hamilton Mountain

The study trees at Hamilton Mountain are located along F.S. Roads 29N46, 28N96 and 29N85. Elevation ranges between 6,000 and 7,000 feet and the trees are located in the 30 in. isohyetal precipitation zone.

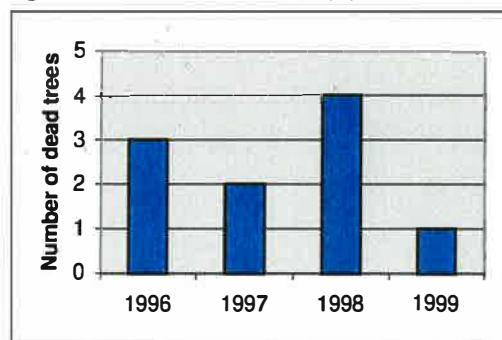
As of July 26, 1999 ten trees have died. The initial condition of the trees is summarized in Table 2. Figure 2. displays the number of trees by the year they died.

Condition of the remaining 90 trees is as follows: 1 tree has dropped the faded needles from 1998 but showed no other changes, 3 trees had new branch fade, 3 trees had their tops blown out and 83 trees were unchanged.

Table 2. Summary of Hamilton Mtn. trees that have died since the study was initiated.

Tree #	Species	DBH (in)	% Top Kill	Scattered Branch Flagging	% Circumference with frass	Date Dead
12	WF	18.9	0	10	10	July 1997
13	WF	16.6	0	10	10	July 1997
17	WF	15.1	31	40	40	June 1996
27	WF	24.9	70	0	0	Oct. 1998
32	WF	13.3	41	0	0	June 1996
34	WF	18.5	51	50	0	Oct. 1998
38	WF	13.7	0	10	0	Oct. 1998
39	WF	20.4	0	50	0	Oct. 1996
75	RF	21.9	24	10	0	Oct. 1998
96	RF	20.6	45	10	0	July 1999

Figure 2. Number of trees by year of death.



Discussion

The 6 month salvage marking guidelines developed in 1992 by FPM specialists for true fir were conservative because we did not feel that any other criteria would be legally defensible on our part due to lack of data available and the difficulty in determining the number of fir engraver attacks on individual trees. Under these salvage marking criteria only trees with at least 50% of the live crown exhibiting crown fade or dieback from the top and/or those with white frass or boring dust around 75% of the bole circumference could be marked as salvage.

Several Forests were using the criteria of 10% top kill for salvage which could not be supported by FPM specialists. An extensive amount of research has been conducted by George Ferrell, P.S.W. Research Station Entomologist, looking at the use of phenotypic traits to predict mortality of true firs in Northern California, however, the hazard rating systems that were

developed were to be used to predict the probability of tree death within 5-10 years not within shorter time frames like 6 months. In addition, these systems were developed when fir engraver populations were at endemic levels not during periods of high populations levels (as evidenced by the tremendous amount of white fir mortality) as those experience here during the protracted drought period during the late 1980's and early 1990's.

Precipitation levels are probably the most important factor influencing conifer mortality in the Sierra Nevada and Southern Cascade mountain ranges. Mortality tends to increase whenever winter precipitation is less than about 80% of the long term normal. As mentioned above, we were experiencing a drought and high levels of conifer mortality, particularly that of white fir, during the early 1990's. Figure 3. shows the Palmer Drought Index (PDI) for the Sierra Cascade region from 1987 through 1999. The PDI is an index of meteorological drought or moisture excess that ranges from -4 to +4, with negative values denoting dry spells and positive values denoting wet spells. Figure 4. shows the levels of fir and pine mortality as detected during aerial surveys between 1993 and 1998.

Figure 3. Palmer Drought Severity Index for the Sierra Cascade area from 1987 – 1999.

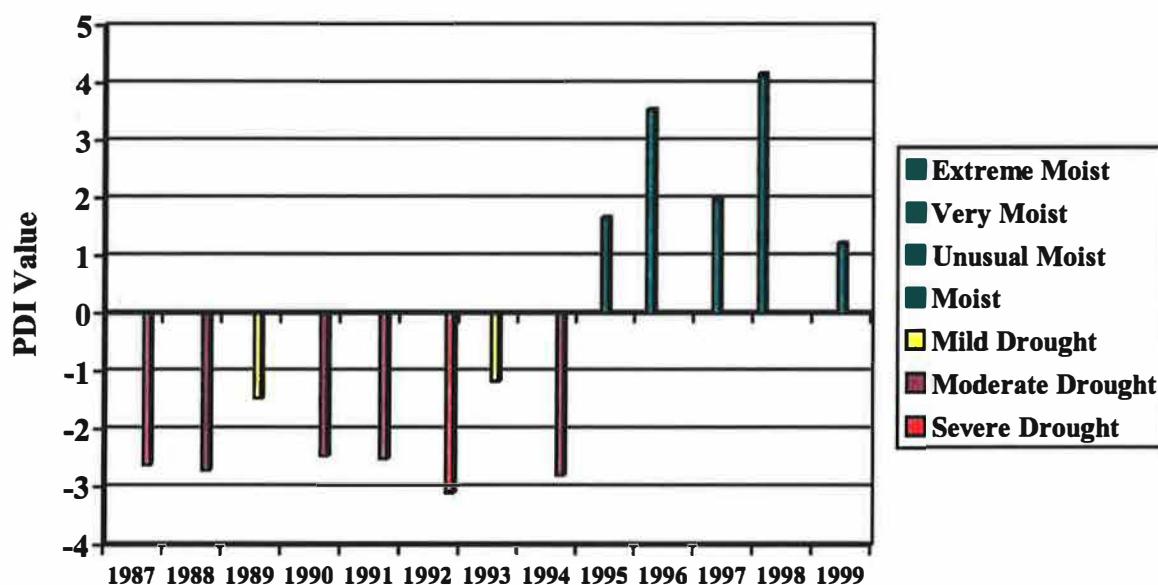
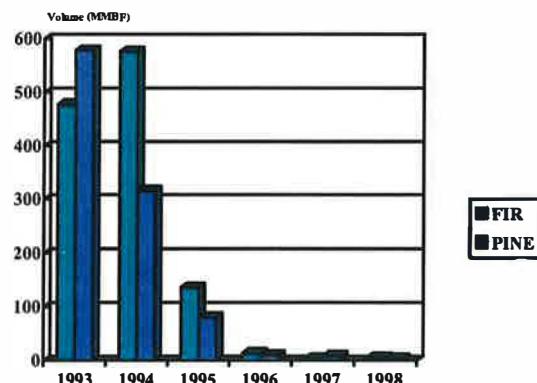


Figure 4. Volume of fir and pine mortality on National Forests in the Southern Cascades and Sierra Nevada mountain ranges between 1993 and 1998 as detected by aerial surveys.



Implementation of the true fir monitoring studies on Antelope and Hamilton Mountains in 1995 occurred during the same year that precipitation levels returned to normal or above normal following drought conditions between 1987 – 1994. A dramatic decrease in true fir mortality throughout the Southern Cascades and Sierra Nevada forests was also observed during 1995. There is no doubt, that the return of normal precipitation levels influenced the study trees in the study areas as well.

Unlike the pine bark beetles, which are only successful if they mass attack and kill a tree, fir engraver beetles can be successful without causing tree mortality. In addition, the outward signs of fir engraver beetle attacks are not as obvious as the pitch tubes created by *Dendroctonus* sp. Therefore, the ability to accurately predict true fir that will be dead within 6 months is not possible under most conditions. Our study shows that even the amount of current top kill should not be used to predict true fir mortality, particularly under short time frames. Initially, there were 113 trees that had at least 10% top kill of which 12 had >50% top kill (Figure 5.). The fifteen trees that died between 1995 and 1999 had top kill percentages ranging from 0 to >50%, with the highest number of dead trees falling in the “no initial top kill” category (Figure 6.). Several of the trees with no initial top kill died within the first 2 years, whereas the 2 trees with greater than 50% top kill did not die until after 3 years.

Figure 5. Total number of trees by initial amount of top kill.

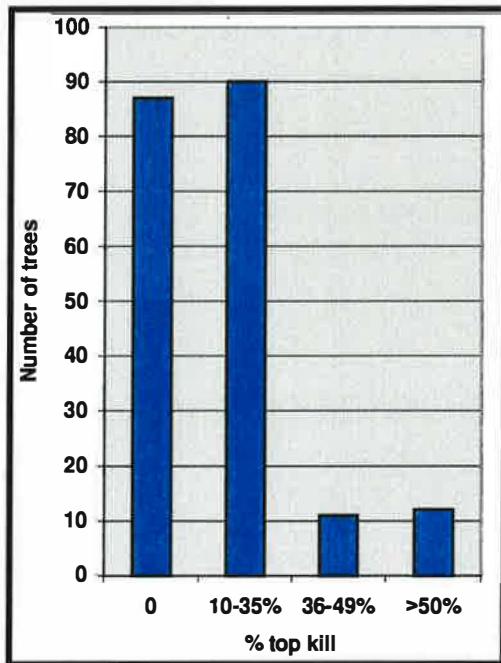
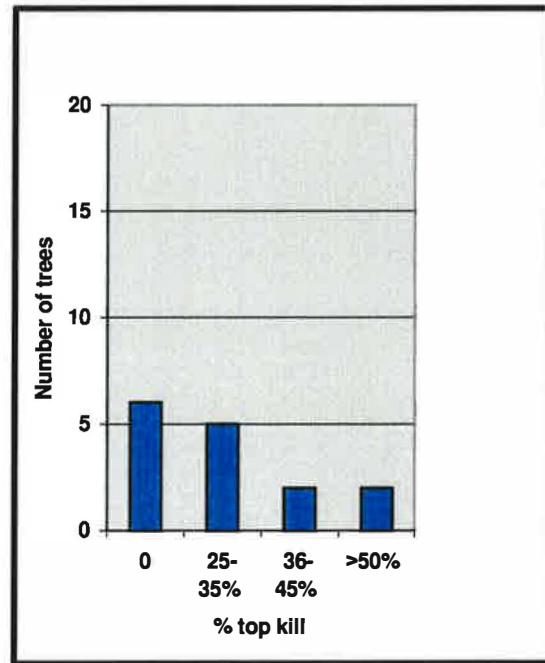


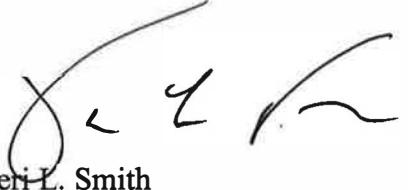
Figure 6. Total number of trees that have died over 4 years by initial amount of top kill.



It is clear that under the conditions of this study that even top kill is not a consistent valid criteria to use for predicting tree mortality, for periods of up to least up to 4 years. These results are comparable with those found in similar studies initiated by FPM on the Stanislaus National Forest during 1992.

In subsequent research by George Ferrell and others in 1993, they concluded that the use of phenotypic traits to predict tree mortality during fir engraver outbreaks periods, caused by rapid onset of stress during drought periods, was not adequate on either an individual tree or stand basis. Our findings support this research as well for individual trees. They did find good correlation between stand basal area and composition. If stands are overstocked and thinning true fir is prescribed, it is likely that determining the desired residual basal area and leaving the largest, healthiest and best-formed trees will result in healthier post-harvest stands than attempting to implement short-term marking criteria that have to be extremely conservative because of the inconsistencies observed in studies such as this one. In the future, it is recommended that studies such as these be used to document our current inability to consistently predict true fir mortality based on individual tree criteria for periods of <5 years.

Please call Sheri Smith or Robin Petersen if you have any questions regarding this monitoring report (530) 252-6667.



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Attachment 1

Six Month Salvage Marking Guidelines
for
Areas with Management Responsibilities
for the California Spotted Owl

25 June 1992

Trees meeting one or more of the following guidelines are expected to die within 6 months and can be marked for salvage:

(A) Pine. (Ponderosa, Sugar and Jeffrey pines)

(1) Trees with at least 50% of the live crown exhibiting current, active, contiguous, crown fade/dieback from the top. Specifically excludes older top-kills with very few or no needles remaining.

(2) Trees with less than 50% of the live crown exhibiting current, active, contiguous, crown fade/dieback from the top with one or more of the following:

(a) Pitch tubes. Pink to reddish pitch tubes are numerous (>10), and are found over at least 50% of the circumference of the bole, at or above 5 feet, and extending at least 10 to 15 additional feet up the bole. Specifically excludes whitish pitch tubes that do not have pink or reddish boring dust associated with them. Because of drought stress, pitch tubes may or may not be present in trees currently infested with bark beetles.

(b) Boring dust/frass. Pink to reddish, fine granular to dust-like, boring dust/frass in bark crevices, webbing along the bole, or that accumulates at the base of the tree, present over at least 1/3 of the bole circumference. Specifically excludes boring dust/frass associated only with old wounds, fire scars etc.

Criteria 2a and 2b specifically exclude basal attacks by the red turpentine beetle which are characterized by very large pitch tubes, associated with coarse boring dust, generally restricted to the lower 2 to 3 feet of the bole. During periods of stress, as during the current drought, red turpentine beetle attacks may extend above the 2 to 3 foot level along the bole but are not to be considered valid marking criteria under the 6 month marking guidelines.

(B) True Fir. (White and Red Fir)

(1) Trees with at least 50% of the live crown exhibiting current, active, contiguous, crown fade/dieback from the top. Specifically excludes older top-kills with very few or no needles remaining.

(2) Trees with less than 50% of the live crown exhibiting current, active, contiguous, crown fade/dieback from the top with the following:

(a) Boring dust/frass. Whitish, fibrous, boring dust/frass found in bark crevices and/or webbing along the bole, at DBH or higher and around at least 75% of the bole circumference.

These guidelines for true fir specifically exclude pitch streaming as a valid 6 month salvage marking criteria.

Attachment 2

STUDY PLAN TRUE FIR MONITORING ANTELOPE MOUNTAIN HAMILTON MOUNTAIN EAGLE LAKE RANGER DISTRICT LASSEN NATIONAL FOREST

Background and Need:

Previous studies conducted on true fir mortality, due to insect attack, do not provide adequate information regarding the predictability of tree mortality occurring within 6 months. This study will attempt to validate the marking guidelines and also provide information that will be useful for vegetation management that involves true fir.

Objective: To evaluate, document, and monitor how quickly merchantable-size fir trees that exhibit signs of insect attack (ie. clear pitch streaming, boring dust, exit holes) fade and die.

Plan of Work:

A. Time frame: The study will be implemented during the fall of 1995 and will continue for a minimum of four years or longer as necessary and appropriate.

B. Procedure: A minimum of 100 trees will be selected at each site.

1. Specific criteria for each tree is as follows:

- a) minimum DBH - 11 inches (merchantable size)
- b) less than 50% crown fade or dieback from the top

All signs and symptoms of attack by insects and diseases and other tree conditions will be documented. These may include but are not limited to the following:

Conditions: top dieback, individual branch dieback
Diseases: Cytospora canker, dwarf mistletoe
Insects: frass, clear pitch steaming, beetle exit holes

2. The selected trees will be marked using orange or yellow paint. Two bands will be painted at approximately breast height, below this an individual tree number will be painted and there will be a butt mark at ground level.

3. The selected trees will be protected for the duration of the study from management activities that could influence the results. Trees that die during the study, may be considered for salvage as part of normal salvage sale procedures if (1) they have been photographed and otherwise

documented according to the study monitoring requirements, and (2) tree removal will not impact the remaining designated study trees so as to affect their survival and influence the results of this study.

4. Initially each tree will be photographed to document the condition of the tree. One photo will show the full tree. Additional photos will be taken as deemed necessary to show the amount of pitch streaming and the presence of attack by insects and diseases. Subsequent photographs will be taken as necessary to document further changes in tree condition (e.g. when crown fades, additional attacks by insects and diseases become apparent.)

5. The following data will be taken for each tree.

- a) Species (red or white fir)
- b) DBH
- c) Tree height
- d) Live crown ratio
- e) # and location of pitch streams
- f) amount of frass
- g) the presence of diseases will be noted

6. The following data will be taken for the general area where the trees are located.

- a) site index
- b) slope
- c) aspect

7. Maps will be developed showing the area where the trees are located and the location of the selected trees within that area.

C. Monitoring: The criteria for monitoring tree conditions is as follows:

1. Tree condition

- a) live
- b) dead
- c) crown fade
- d) top-kill
- e) branch dieback
- f) other

2. Cause of condition

- a) subsequent insect or disease attack
- b) other

3. Frequency of monitoring

- a) Initial (set up and photographs) fall 1995
 - * District personnel will be involved with tree selection.
- b) Duration for a minimum of four years
- c) Annually or more often as needed (dependent on accessibility).

D. Data Steward:

1. FPM will initiate data management and be responsible for data collection. District personnel will be involved as much as they desire. District personnel are encouraged to become involved.

E. Reports:

1. FPM will write monitoring reports as needed to document changes in tree condition. Reports will be distributed as appropriate.